and moved to the south New England coast and thence to western Nova Scotia; clearing weather occurred in the Atlantic coast states; falling followed by rising temperature was noted from the Lake region and Mississippi River eastward; and wind velocities exceeding 50 miles per hour were recorded at points along the Atlantic coast north of the Carolinas. By the 31st the center had passed over the Gulf of Saint Lawrence.

XIV and XIV*a*.—Number XIV was central off the northwestern coast of Washington the morning of the 29th, with pressure below 29.00, heavy gales reaching a velocity of 85 miles per hour from the west at Fort Canby, Wash., and heavy rain on the Pacific coast north of the 35th parallel. By the evening report the center had advanced to the region north of Montana, with an apparent loss of strength, and by the morning of the 30th had moved to the upper Missouri valley, after which it apparently united with XIV*a*, which appeared over the middle plateau region the morning of that date. Low area XIV*a* moved eastward to the vicinity of Salt Lake City, Utah, by the evening of the 30th, without evidence of marked energy, whence it passed to Indian Territory by the close of the month, when a trough of low pressure extended from the western Lake region to Texas, with marked barometric gradients to the east and west. A notable feature of these low areas was the exceptionally heavy snowfall over the middle plateau region during the 29th and 30th.

On the last day of the month a low area of considerable energy was central off the north Pacific coast, where the pressure fell below 29.60, and high winds reaching a velocity of 72 miles per hour from the southeast at Fort Canby, Wash., were noted. On this date an area of high pressure advanced from the Pacific Ocean over California to the middle plateau region; snow fell in the Sacramento Valley, and over the middle and northern plateau regions, and rain prevailed along the Pacific coast.

Tabulated statement showing principal characteristics of areas of high and low pressure.

Barometer.	First observed.			Last observed.		Duration.	Velocity per hour.	Maximum pressure change and maximum abnormal temperature change in twelve hours and maximum wind velocity.									
	Date.	Lat. N.	Long. W.	Lat. N.	Long. W.			Station.	Rise.	Date.	Station.	Fall.	Date.	Station.	Direction.	Miles per hour.	Date.
High areas.		°	°	°	°	*Days.*	*Miles.*		*Inch.*			°					
I*	1	34	82	44	64	3.0	21	Father Point, Quebec	.28	3	Lynchburgh, Va	7	1	Key West, Fla.	ne.	28	1
II	2	42	124	34	76	3.5	36	Cairo, Ill	.44	4	Palestine, Tex	24	3	Savannah, Ga.	w.	36	4
III	5	44	125	35	83	3.5	36	Abilene, Tex	.46	6	El Paso, Tex	32	5	Helena, Mont	sw.	36	6
IV†	10	45	118	37	108	6.0	6	Tatoosh Island, Wash	.41	10	Pueblo, Colo	21	10	Helena, Mont	w.	30	10
V	11	42	101	33	81	2.5	25	White River, Ont	.42	11	Winnipeg, Man	20	10	Kitty Hawk, N. C	ne.	34	12
VI	14	50	85	44	68	1.0	33	Quebec, Quebec	.38	14	Montreal, Quebec	17	14	Block Island, R.I.	e.	38	15
VII	15	53	104	46	69	4.5	24	Father Point, Quebec	.60	17	Chicago, Ill	23	15	Kitty Hawk, N. C	n.	38	18
VIII	22	41	113	35	115	1.0	25	Salt Lake City, Utah	.32	22	Montrose, Colo	20	22	Yuma, Ariz	nw.	24	22
IX	24	51	114	35	107	3.0	20	Fort Assinaboine, Mont.	.66	23	La Crosse, Wis	37	25	Pueblo, Colo	w.	46	26
X	27	28	92	45	63	2.0	49	Brownsville, Tex	.40	26	Raleigh, N. C	23	27	Galveston, Tex	nw.	36	26
XI	28	37	113	44	74	3.0	35	Pueblo, Colo	.52	28	Winnemucca, Nev	26	27	Savannah, Ga	nw.	34	30
XII	29	52	97	44	74	2.0	27	White River, Ont	.66	30	Qu'Appelle, N. W. T	42	28	Erie, Pa	se.	30	31
Mean						2.9	28		.46			24				34	
Low areas.									Fall.			Rise.					
I‡	1	52	109	52	93	1.0	29	Indianapolis, Ind	.24	1	Shreveport, La	18	1	Chicago, Ill	se.	57	1
II	2	40	103	51	68	3.5	24	Chatham, N. B	.76	5	Concordia, Kans	17	2	Woods Holl, Mass	se.	63	4
III	5	35	98	47	60	2.0	50	Sydney, C. B. I	.52	7	El Paso, Tex	24	4	Chicago, Ill	nw.	48	6
IV	7	53	128	51	63	2.5	46	Swift Current, N. W. T	.54	7	Calgary, N. W. T	25	6	Fort Canby, Wash	s.	98	7
V	9	54	110	50	67	1.5	53	Halifax, N. S	.22	10	Shreveport, La	16	9	Cheyenne, Wyo	w.	56	9
VI	12	52	114	48	60	4.5	31	Eastport, Me	.94	16	Yarmouth, N. S	23	16	Pueblo, Colo	n.	60	14
VII	12	55	106	50	61	1.5	56	Sydney, C. B. I	.30	13	Prince Arthur, Ont	13	12	Buffalo, N. Y	sw.	50	12
VIII	16	52	128	53	108	1.0	35	Edmonton, N. W. T	.40	16	Moorhead, Minn	14	17	Fort Canby, Wash	se.	52	16
IX	18	51	128	50	97	2.5	32	Battleford, N. W. T	.44	19	Pueblo, Colo	15	19	Tatoosh Island, Wash	w.	62	20
X	21	42	99	52	64	2.0	41	Sault de Ste. Marie, Mich.	.36	22	Louisville, Ky	19	21	Chicago, Ill	sw.	44	22
XI	22	26	99	38	85	1.5	33	Parkersburgh, W. Va	.34	24	Little Rock, Ark	10	22	Vicksburg, Miss	w.	48	23
XII	22	50	126	51	65	4.5	32	Father Point, Quebec	.66	26	Saint Vincent, Minn	25	23	Buffalo, N. Y	sw.	66	26
XIII	26	52	128	43	63	4.5	31	Medicine Hat, N. W. T	.72	27	Rockliffe, Ont	33	28	Fort Canby, Wash	s.	88	26
XIV	29	48	127	48	107	1.0	40	Spokane, Wash	.54	29	Medicine Hat, N. W. T	35	29	Fort Canby, Wash	w.	85	29
XIV*a*	30	42	117	37	98	1.5	31	White River, Ont	.54	31	Pueblo, Colo	25	30	Pueblo, Colo	n.	42	31
Mean						2.3	38		.51			21				61	

*Continuation of high area VIII for November, 1891. †Remained nearly stationary over middle plateau, 11th to 15th, inclusive. ‡Continuation of low area XIII for November, 1891.

NORTH ATLANTIC STORMS FOR DECEMBER, 1891 (pressure in inches and millimeters; wind-force by Beaufort scale).

The paths of storms that appeared over the west part of the north Atlantic Ocean are shown on Chart I. These paths have been determined from reports of shipmasters received through the co-operation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."

In December there is usually an increase of pressure over the north Atlantic Ocean south of the 30th parallel and from the British Isles over the Azores and Cape Verde Islands. Between the Azores and the coast of the United States and thence northward there is a decrease of pressure, the decrease being most marked within the Iceland area of low pressure, where it exceeds .20. The normal distribution of pressure over the north Atlantic in December shows a belt of high pressure stretching across the ocean between the 30th and 40th parallels, with values above 30.10 (764), from which there is a marked gradient to Iceland and southern Greenland, where the pressure falls below 29.50 (749). This distribution of pressure has an apparent effect upon the course of ocean storms; they follow two principal tracks which diverge from the main continental track east of Newfoundland, one running directly into the Iceland low area, and the other skirting its southern quadrants and passing north of the British Isles. The average velocity of north Atlantic storms in December is about 21 miles per hour, and an average of 3 storms traverse the ocean from the American to the European coasts in that month.

The storms traced over the north Atlantic Ocean for December, 1891, were attended by gales of seasonal severity. Three of the storms traversed the ocean, the tracks being plotted from the Canadian Maritime Provinces to the region north of the British Isles. One of these storms is traced as low area IV; it left the Pacific coast on the 7th, passed north of Newfoundland the night of the 9–10th, was central west of the British Isles on the 13th, and disappeared in the direction of Scandinavia by the 14th. The following is a description of the storms which appeared during the month:

The month opened with low pressure from Newfoundland to

the British Isles. A storm of marked energy was central over mid-ocean in high latitudes, with pressure below 29.00 (737) and gales of force 10 to 11 along the trans-Atlantic tracks, and a storm of moderate strength was central south of the Banks of Newfoundland. Under the influence of high area I high pressure obtained off the American coast from Nova Scotia to the West Indies. The slow passage of this high area northeastward off the coast of the United States and thence over Nova Scotia caused a continuance of high pressure and generally fine weather west of the 60th meridian during the first five days of the month. On the 2d the storm south of the Grand Banks on the 1st had passed northeastward and united with the storm which occupied mid-ocean, and pressure below 29.00 (737) and gales of hurricane force were reported between the 20th and 40th meridians. Pressure falling to 29.10 (739) was noted in England, and southwesterly winds and rain prevailed over the British Isles.

By the 3d the mid-ocean storm had apparently moved northeastward; pressure falling to 29.30 (744) was reported near the Hebrides; and southerly winds prevailed over the British Isles, with rain in Great Britain. The pressure continued low over mid-ocean and off the British Isles during the 4th, after which there was an increase of pressure in those regions. By the 5th high area I had passed southeastward from Nova Scotia and was central south of the Banks of Newfoundland, and the pressure was generally above the normal over the entire ocean. By the 6th high area I had joined the permanent Atlantic high area, and high area II appeared off the south Atlantic coast of the United States. Low area II had advanced from the Saint Lawrence Valley, and occupied the region north of Newfoundland. The night of the 6th a storm, with pressure below 29.10 (739), is reported as having moved northeastward over Great Britain, causing damage to shipping along the French and English coasts. On the 7th high area II moved east of Bermuda; low area II passed north of the Grand Banks, without evidence of marked energy; and pressure was above the normal from the Azores to the British Isles.

On the 8th the pressure continued high between the 30th and 40th parallels; low area II had advanced to mid-ocean in high latitudes, attended by whole gales; and the night of the 7–8th southerly gales prevailed over Newfoundland. On the 9th high pressure prevailed over the southeastern part of the United States under the influence of high area III, and the pressure was high thence eastward over the ocean; low area II advanced eastward, with gales of force 9 to 11 between the 10th and 30th meridians. During the 10th high pressure continued south of the 40th parallel; low area II passed over or north of Scotland, with pressure falling to about 28.60 (726) near the Shetland Islands, and southwesterly gales prevailed over the British Isles. The storm set in over Great Britain and Ireland the night of the 9th and continued with destructive violence during the 10th, causing many disasters and loss of life on land and sea. Low area IV, which had advanced from the north Pacific coast, was central northeast of Newfoundland the morning of the 10th. The pressure continued high south of the 40th parallel during the 11th; low area IV had advanced to mid-ocean, with pressure falling to about 29.50 (749); low area V had advanced to northern Newfoundland; and low area II had passed over the North Sea, without an apparent loss of energy.

By the 12th low area IV had advanced east of the 30th meridian, with pressure below 29.00 (737) and gales of force 10 to 11; and low area V was apparently central north of the Grand Banks. Low area IV moved over the north part of the British Isles during the 13th, with pressure falling to about 29.20 (742); low area V advanced to about the 40th meridian, with central pressure near 29.50 (749); and the pressure was high off the middle and south Atlantic coasts of the United States under the influence of high area V. High area V was central off the south Atlantic coast on the 14th; low area V advanced to mid-ocean with a moderate display of strength; and low area IV had disappeared in the direction of the Baltic Sea, where pressure 28.90 (734) was reported. On the 15th low area VII, which had moved eastward north of the Gulf of Saint Lawrence during the 13th, was central over mid-ocean, with pressure about 29.20 (742), and gales of hurricane force; low area V occupied a position northwest of Ireland; and high area V remained central near Bermuda. By the 16th low area VII had apparently developed marked energy, and the passage of low area VI over New England and the south part of the Gulf of Saint Lawrence caused low pressure and fresh gales south of Nova Scotia.

The night of the 16th low area VI passed northeastward over Newfoundland, with pressure falling to 29.11 (739) at Saint Johns, and strong southeast gales, heavy rain, and snow. On the 17th this storm was central north of the Grand Banks, and a fresh southwest gale was reported at Bermuda. On this date a slight cyclonic area approached the Florida Peninsula from the east Gulf. On the 18th low area VI reached mid-ocean in high latitudes, with pressure about 29.20 (742), and gales reaching force 10 to 11; the cyclonic area from the east Gulf crossed the Florida Peninsula, and afterwards apparently dissipated off the south Atlantic coast. During the 19th the pressure was high along the middle Atlantic coast under the influence of high area VII; the pressure continued low over mid-ocean; and high pressure prevailed over the British Isles. On the 20th high area VII passed southeastward from Nova Scotia, the pressure continued abnormally high over the British Isles; and low pressure prevailed between the 30th and 50th meridians. From the 21st to 23d the pressure continued high over the east and west parts of the ocean, and a low area occupied the region lying south of Iceland.

On the 24th low area X, which had passed north of the Saint Lawrence Valley during the 23d, was apparently central south of Greenland, with gales of force 10 to 11 over and east of the Grand Banks. By the 25th this storm had advanced to mid-ocean, with pressure below 29.00 (737) and gales of hurricane force, and on the 26th was central northwest of the British Isles, whence it moved eastward north of Scotland by the 27th. On the 23d low area XII passed eastward north of Newfoundland, and reached mid-ocean by the 28th, attended by pressure falling to about 29.00 (737) and gales of force 10 to 11. By the 29th this storm had advanced to the region south of Iceland, where it apparently remained nearly stationary until the 30th, after which it probably passed over or north of the North Sea. From the 27th to 29th high pressure prevailed along the Atlantic coast of the United States, attending the passage of high area X from the Gulf of Mexico to Nova Scotia. At the close of the month the pressure was high over mid-ocean, and low pressure and fresh gales prevailed south of Nova Scotia under the influence of low area XIII which occupied the Gulf of Saint Lawrence.

OCEAN ICE IN DECEMBER.

No Arctic ice was reported for December, 1891. In December, 1882, 1883, 1884, 1886, and 1888, no Arctic ice was reported near Newfoundland and the Grand Banks. In 1885 several icebergs were observed off the Newfoundland coast the latter part of the month. In 1887 a small iceberg was reported in N. 46° 10′, W. 47° 28′ on the 26th, and a small iceberg in N. 48° 20′, W. 48° 40′ on the 28th.

FOG IN DECEMBER.

The limits of fog belts west of the 40th meridian, as determined from reports of shipmasters, are shown on Chart I by dotted shading. East of the 55th meridian fog was reported on 4 dates; between the 55th and 65th meridians on 4 dates; and west of the 65th meridian on 5 dates. Compared with the corresponding month of the last 4 years the dates of occurrence of fog east of the 55th meridian numbered the same as the average; between the 55th and 65th meridians one less than the average; and west of the 65th meridian 2 less than the average. The occurrence of fog along the steamship tracks west of the 40th meridian and at stations of the Weather Bureau along

the New England and middle Atlantic coasts generally attended the approach or passage of general storms.

A notable feature of the month was the exceptionally dense fog which enveloped London, England, from the 22d to 26th.

TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

Many of the voluntary stations do not have standard thermometers or shelters.

The distribution of mean temperature over the United States and Canada for December, 1891, is exhibited on Chart II by dotted isotherms. In the table of miscellaneous meteorological data the monthly mean temperature and the departure from the normal are given for regular stations of the Weather Bureau. The figures opposite the names of the geographical districts in the columns for mean temperature and departure from the normal show, respectively, the average for the several districts. The normal for any district may be found by adding the departure to the current mean when the departure is below the normal and subtracting when above. The monthly mean temperature for regular stations of the Weather Bureau represents the mean of the maximum and minimum temperatures.

The mean temperature was highest over extreme southern Florida, where it was above 70; it was above 60 over the Florida Peninsula, in extreme southern Louisiana, and in the lower Rio Grande valley; and was above 50 over the southern half of the Gulf States, along the Mississippi River to Memphis, Tenn., over extreme southern California and southwestern Arizona, and along the immediate Pacific coast south of San Francisco, Cal. The mean temperature was lowest in Manitoba and thence over the Saskatchewan Valley east of the 110th meridian, where it was below 10; it was below 15 over northern North Dakota and northwestern Minnesota, and in the mountains of central Colorado; and was below 30 north of a line traced from the south part of the Gulf of Saint Lawrence westward over the Lake region and the upper Mississippi valley to north-central Nebraska, thence southward to central New Mexico, thence west-northwest to the Sierra Nevada range of mountains, which it followed to central Oregon, thence eastward over the valley of the Columbia River to northern Idaho, and thence northwestward over British Columbia.

DEPARTURES FROM NORMAL TEMPERATURE.

The mean temperature was generally above the normal east of the Rocky Mountains and in northeastern Oregon and eastern and northern Washington; elsewhere it was below the normal. The most marked excess in temperature was noted in northern Ontario, where it was more than 10, and the excess was more than 5 in the Atlantic coast states north of Virginia, and in districts north of the Ohio and Missouri Rivers. The most marked deficiency was reported over the middle and southern plateau regions, where it was more than 5, and a slight deficiency was noted along the immediate middle Gulf coast from western Florida to eastern Texas.

DEVIATIONS FROM NORMAL TEMPERATURE.

The following table shows for certain stations, as reported by voluntary observers, (1) the normal temperature for December for a series of years; (2) the length of record during which the observations have been taken, and from which the normal has been computed; (3) the mean temperature for December, 1891; (4) the departure of the current month from the normal; (5) and the extreme monthly mean for December during the period of observation and the years of occurrence:

Deviations from normal temperature—Continued.

State and station.	County.	(1) Normal for the month of Dec.	(2) Length of record.	(3) Mean for Dec., 1891.	(4) Departure from normal.	(5) Extreme monthly mean for December. Highest.	Year.	Lowest.	Year.
Arkansas.		°	*Years*	°	°	°		°	
Lead Hill	Boone	39.4	10	44.4	+ 5.0	55.3	1889	29.1	1884
California.									
Sacramento	Sacramento	46.7	37	38.7	− 8.0	50.9	1861	39.4	1891
Connecticut.									
Middletown	Middlesex	28.6	23	37.9	+ 9.3	37.9	1891	21.8	1872
Florida.									
Merritts Island	Brevard	62.6	9	68.0	+ 5.4	68.0	1891	58.0	1885
Georgia.									
Forsyth	Monroe	49.8	17	52.0	+ 2.2	61.3	1889	39.8	1876
Illinois.									
Peoria	Peoria	29.3	36	38.5	+ 9.2	44.3	1877	18.5	1876
Riley	McHenry	22.9	35	31.4	+ 8.5	37.7	1877	11.1	1876
Indiana.									
Vevay	Switzerland	34.9	26	41.7	+ 6.8	49.0	1889	24.6	1876
Iowa.									
Cresco	Howard	17.4	20	28.3	+10.9	34.0	1877	4.5	1876
Monticello	Jones	21.8	37	31.3	+ 9.5	39.5	1877	8.1	1859
Logan	Harrison	26.0	17	34.6	+ 8.6	39.6	1889	15.4	1879
Kansas.									
Lawrence	Douglas	30.7	24	38.3	+ 7.6	44.8	1889	19.8	1872
Wellington	Sumner	33.3	12	.....	.....	46.2	1889	23.1	1884
Louisiana.									
Grand Coteau	Saint Landry	56.3	9	54.7	− 1.6	65.0	1889	51.8	1887
Maine.									
Orono	Penobscot	20.8	21	31.6	+10.8	31.6	1891	11.4	1890
Maryland.									
Cumberland	Allegany	31.9	32	39.6	+ 7.7	43.2	1889	24.8	1866
Massachusetts.									
Amherst	Hampshire	33.6	45	37.2	+ 3.6	37.2	1891	19.5	1872
Newburyport	Essex	30.2	13	37.9	+ 7.7	37.9	1891	23.4	1890
Somerset	Bristol	30.6	19	40.7	+10.1	40.7	1891	21.8	1876
Michigan.									
Kalamazoo	Kalamazoo	29.4	15	36.0	+ 6.6	40.2	1889	16.7	1876
Thornville	Lapeer	27.7	14	35.4	+ 7.7	38.0	1889	19.6	1886
Minnesota.									
Minneapolis	Hennepin	15.5	27	27.2	+11.7	31.6	1877	1.9	1872
Montana.									
Fort Custer	Custer	22.8	12	29.4	+ 6.6	33.1	1885	5.6	1884
New Hampshire.									
Hanover	Grafton	20.6	53	29.5	+ 8.9	31.2	1847	10.2	1872
New Jersey.									
Moorestown	Burlington	32.4	28	40.7	+ 8.3	41.0	1889	23.9	1876
South Orange	Essex	31.8	21	39.6	+ 7.8	39.6	1891	24.3	1872
New York.									
Cooperstown	Otsego	27.1	37	33.9	+ 6.8	33.9	1891	14.7	1876
Palermo	Oswego	24.8	37	33.8	+ 9.0	33.8	1891	16.8	1880
North Carolina.									
Lenoir	Caldwell	38.2	19	41.7	+ 3.5	48.9	1889	29.1	1876
Ohio.									
N'th Lewisburgh	Champaign	30.1	59	39.0	+ 8.9	44.3	1889	19.0	1876
Wauseon	Fulton	27.2	21	35.5	+ 8.3	38.8	1877,'89	17.1	1872
Oregon.									
Albany	Linn	41.6	12	41.0	− 0.6	49.5	1886	32.1	1884
Eola	Polk	40.0	20	40.2	+ 0.2	47.0	1886,'87	30.7	1884
Pennsylvania.									
Dyberry	Wayne	25.3	24	34.6	+ 9.3	34.6	1891	17.3	1876
Grampian Hills	Clearfield	25.6	27	34.8	+ 9.2	37.0	1877	16.0	1876
Wellsborough	Tioga	29.5	12	34.6	+ 5.1	39.5	1881	22.2	1890
South Carolina.									
Statesburgh	Sumter	47.6	10	50.6	+ 3.0	56.6	1889	43.6	1882
Tennessee.									
Austin	Wilson	40.8	21	46.9	+ 6.1	56.5	1889	25.0	1876
Texas.									
New Ulm	Austin	54.4	18	55.4	+ 1.0	65.8	1889	46.1	1876
Vermont.									
Strafford	Orange	21.6	18	31.2	+ 9.6	31.2	1891	13.4	1890
Virginia.									
Birdsnest	Northampt'n	41.5	23	46.8	+ 5.3	51.1	1879	32.7	1876
Washington.									
Fort Townsend	Jefferson	41.2	16	38.4	− 2.8	45.3	1885	33.0	1884
Wisconsin.									
Madison	Dane	22.9	22	31.1	+ 8.2	38.7	1877	11.7	1876

YEARS OF HIGHEST MEAN TEMPERATURE FOR DECEMBER.

Over the greater part of New England and in parts of eastern New York, eastern Pennsylvania, and New Jersey the current month was the warmest December on record. In New England the mean temperature was 6 to 10 above the normal, and 1 to 2 above the highest mean previously reported for December, noted in 1881 and 1889; in eastern New York, eastern Pennsylvania, and New Jersey the mean was 6 to 9 above the normal, and about 1 above that of 1889; and at Merritts Island, Fla., the mean for the current month was 5.4 above the normal, and 1 above the mean of 1883. The highest mean